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Emerging Technology Bulletin

Innovative Methods for Bioslurry Treatment

IT Corporation

Technology Description: Slurry biodegradation systems are created by combining soil or sludge with water. This technology provides rapid biodegradation, due to enhanced mass transfer rates and increased contaminant to microorganism contact. After appropriate pretreatment, the contaminants are suspended in a slurry form and mixed in a tank. Aeration is provided by spargers. Mixing is provided by aeration alone or by aeration and mechanical mixing. Nutrients and neutralizing agents are supplied to relieve any chemical limitations to microbial activity. Other materials can be used to support growth and induce degradation of contaminants, or increase substrate availability to degradation.

An increased rate and extent of polycyclic aromatic hydrocarbons (PAH) biodegradation in slurry reactors has been developed. Two 60 liters (L) TEKNO Associates bioslurry reactors and a 10-L fermentation unit in semi-continuous, plug-flow mode, were operated for a 6-month period. The first 60-L reactor received fresh feed daily and supplements of salicylate and succinate to enhance PAH biodegradation. A schematic flow diagram of this bioslurry treatment is shown in Figure 1. Effluent from the first reactor is fed to the second 10-L reactor in series, where Fenton's reagent ($Fe^{++} + H_2O_2$ is added to accelerate oxidation of 4- to 6-ring PAHs. The Third reactor in series, biologically oxidizes re-

Figure 1. Schematic diagram of bioslurry treatment. (Source: IT Corp., 1995)
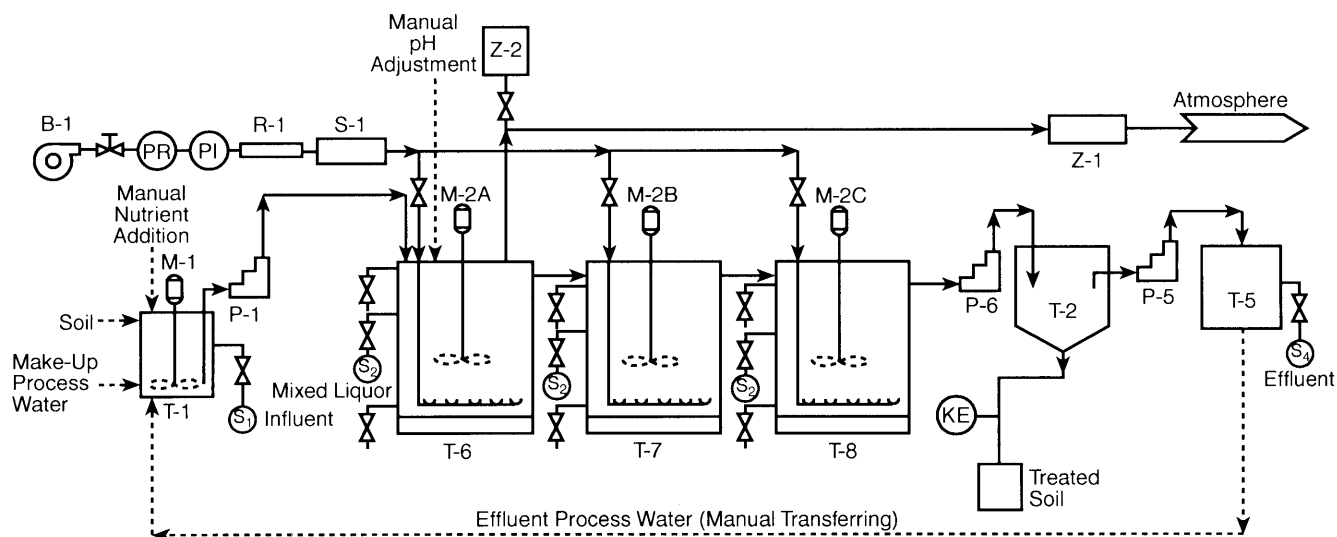
Legend

(S₃) Sample Port   (PR) Pressure Regulator

(PI) Pressure Indicator   (KE) Timer

M-1	B-1	R-1	M-2A,B,C	T-7	Z-1	P-5	Z-2
Feed Mixer	Air Blower	Air Rotameter	Bioreactor Mixer	Bio Reactor 2 (60L)	Carbon Adsorption	Effluent Pump	Air Sampling Device

T-1	P-1	S-1	T-6	T-8	P-6	T-2	T-5
Feed Container (20L)	Feed Pump (12 L/Day)	Air Filter	Bio Reactor 1 (60L)	Bio Reactor 3 (10L)	Slurry Pump	Clarifier	Effluent Container (20L)

maining contaminants, after being treated with Fenton's reagent. R3 received no additions of salicylate and succinate. The reactor was aerated, nutrient-amended, and pH adjusted only.

Waste Applicability: Biosltuy reactors have the potential to treat a wide range of organic contaminants such as pesticides, fuels, creosote, pentachlorophenol (PCP), and some halogenated volatile organics It is expected to treat coal tars, refinery wastes, hydrocarbons, wood-preserving wastes, and organic and chlorinated sludges. The pressure of heavy metals and chlorides may inhibit the microbial metabolism and require pretreatment. These units have demonstrated biodegradation of selected contaminant concentrations ranging from 2,500 to 250,000 milligrams/kilograms (mg/kg).

Test Results: Blended slurry PAH and CPAH maximum concentrations were 6,120 and 434 mg/kg, respectively. The bioslurry reactor system demonstrated up to 95% and 84% transformation of PAH and CPAH, respectively. During optimal operation, the influent PAH concentration was decreased from 6,210 mg/kg to 325 mglkg. Influent CPAH concentrations were decreased from 422 mglkg to 65 mglkg. Total heterophobic counts in RI and R3 ranged from 108 to 109 colony forming unit per milliliter (CFU/

mL). Despite severe conditions maintained in R2, total microbial counts ranged up to 104 CFU/mL.

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